

THE PERKIN-ELMER CORP.



ENGINEERING REPORT

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TECHNICAL PROPOSAL
FOR
SIMPLIFICATION OF HAND CONTROL
PE 500-0133

PREPARED FOR HF 20-80
JANUARY 23, 1957

STAT

CONTAINS SENSITIVE
COMPARTMENTED INFORMATION

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**TECHNICAL PROPOSAL
FOR
SIMPLIFIED HAND CONTROL, MK II**

GENERAL

The following technical proposal is in response to a verbal request by
 [redacted] for a re-examination of the operational requirements of the
 Drift Sight and Hand Control.

STAT

Use of the Drift Sight and Hand Control over the past one and one half years has resulted in a modification of the original philosophy represented by the present design. Some features available are no longer required, while new features are desired. A tabulation of the salient points best illustrates this:

ORIGINAL FEATURE	ORIGINAL PURPOSE	CURRENT TREND	REASON FOR CHANGE
Track rate and scale	1.) Navigational aid.	1.) Eliminate	1.) Other devices available for this function.
	2.) Establish IMC rate for C Configuration.	2.) Retain for C Configuration only.	
Drift angle settings	1.) Navigational aid.	1.) Eliminate	1.) Replaced by Drift scale on D/S eyepiece.
	2.) Part of correction for proper IMC rate setting.	2.) Retain for C Configuration only.	
Hindsight	No requirement	Required	Rearward viewing desired with scanning capability.
100% interchangeability	Requirement	Not required	Special nature of C Configuration may require consideration as a separate package with respect to PAGE 1.
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ORIGINAL FEATURE	ORIGINAL PURPOSE	CURRENT TREND	REASON FOR CHANGE
			<u>specialized Hand Control requirements.</u>

Elimination of the specialized, Hand Control features for use with the C Configuration permits simplification of the Hand Control with consequent reduction in volume and weight. The following applies only to the MK II (FOG) Hand Control, which is an electrical unit.

TRACK AND DRIFT CONTROLS

These controls will be eliminated since the prime feature of this redesigned Hand Control is to provide a means for the pilot to see outside his craft and to scan in all directions. Elimination of these controls will eliminate the integrator, tracking rate motor, and associated gear meshes. Further, since the unit will not and cannot be used with the C Configuration (and Computer attachment) the alpha and beta bale rings, and alpha and rate potentiometers will be removed as will their associated gears and shafts.

Since no tracking feature is available there is no need for declutching the unit by depressing the handle, thereby eliminating the slip clutches, relay and associated circuitry.

ELECTRICAL CONTROLS

The current electrical controls (lights, mode switch, master switch and power changer switch) will be retained unchanged. However the "Store" momentary switch which is used with the "C" Configuration and Computer unit, will be eliminated.

The A and A & E synchros, the two transistorized amplifiers and power inverter (28VDC to 400 cps) will be retained since this servo loop is required to control the scanning of the Drift Sight.

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DRIFT SIGHT

No changes will be made in the Drift Sight.

HAND SIGHT FEATURES

With the elimination of the bale rings, $\pm 90^\circ$ fore-aft motion of the Hand Control knob from vertical will be provided. The motion of the Hand Control knob will also include $\pm 60^\circ$ athwartships from vertical. No directional signal, either visual or touch is required since the position of the Hand Control represents the direction of the line of sight. Detents for the vertical position will be provided since drift angle can only be measured when the line of sight is vertical.

SERVO CONTROL

The overall loop gain of the servo system will be such that the line of sight will follow the Hand Control knob motion with a static error not greater than approximately three mils of arc and a velocity error not greater than about $60^\circ/\text{sec}/\text{degree}$ error.

SENSITIVITY

Since the only torque on the Hand Control knob will be that due to the friction of the gear train the "feel" will be very light and require too delicate a touch. To give the operator the sense or feeling that he is moving something an inertial load will be applied to the A and A & E gear train in the Hand Control. Such a load is continuous and proportional to velocity giving the operator something to push or pull against, a feature which contributes to smooth control.

MECHANIZATION

Figures 1, 2 and 3 illustrate the system currently used in Hand Control
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PE 500-0133 for moving the line of sight and the modifications thereto for elimination of track and drift settings.

Most of the design exists already and can be readily adapted to this form of simplification.

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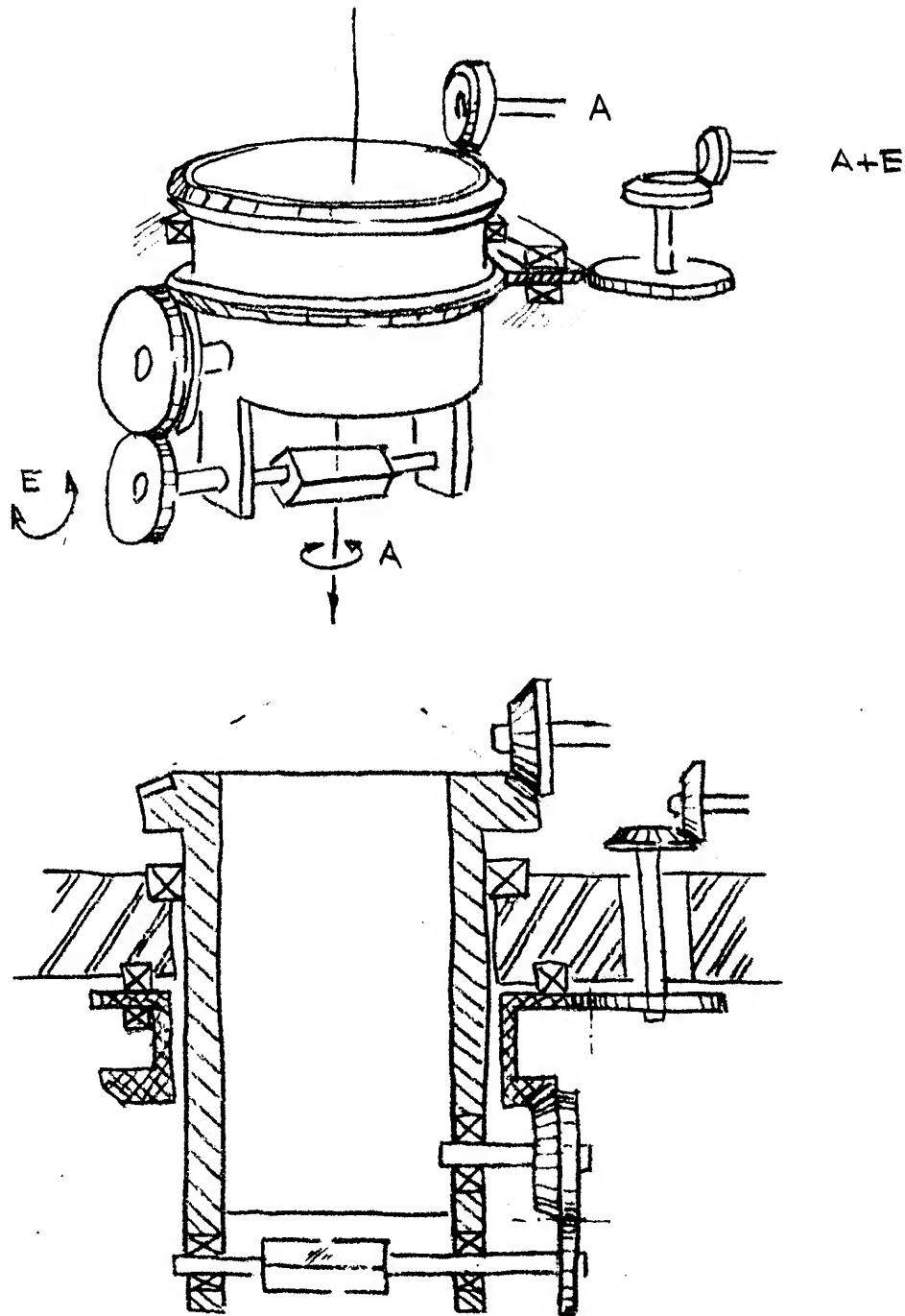
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DRIFT SIGHT SCAN GEARING

FIG 1

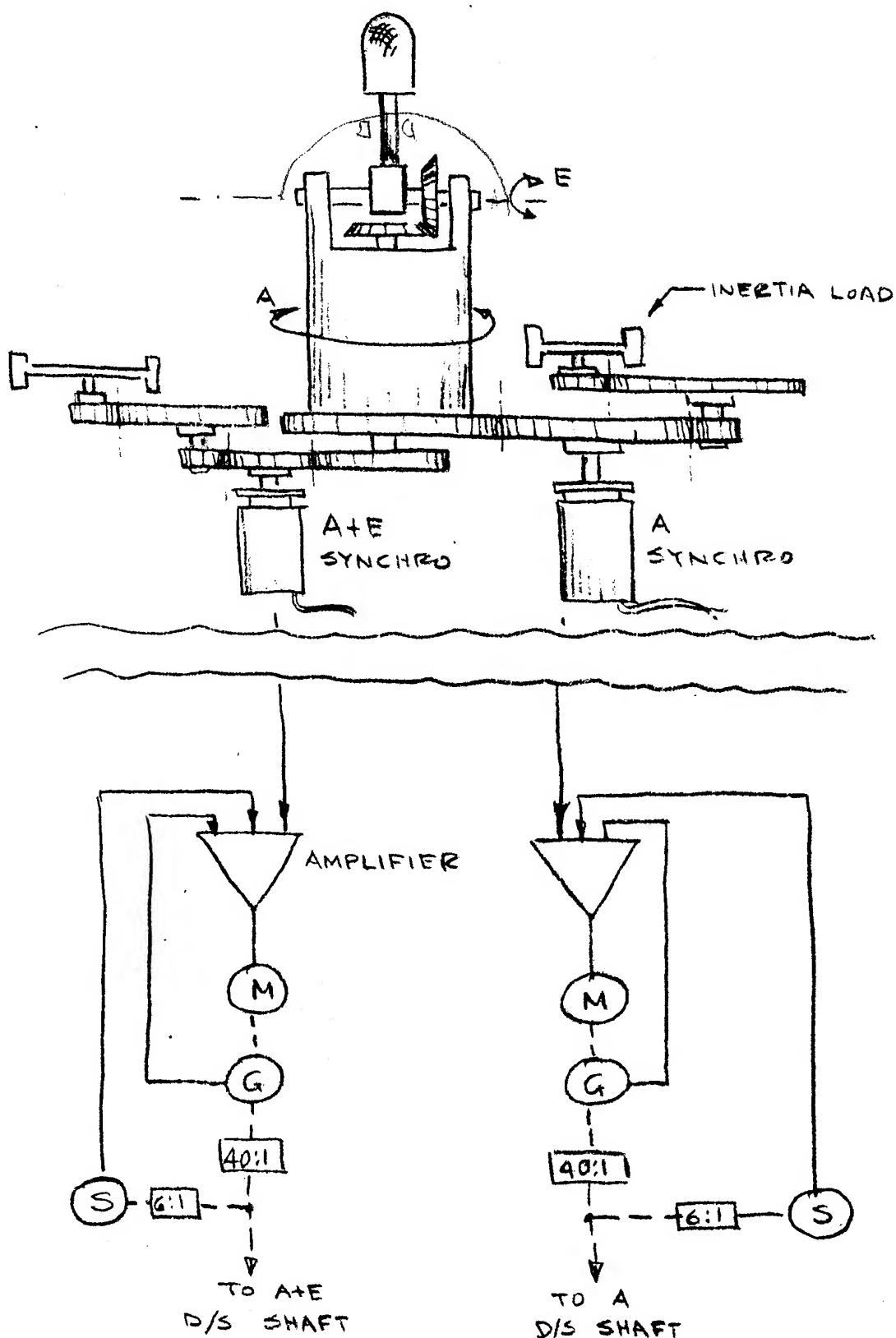
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HAND CONTROL GEARING AND SERVO

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FIG 2

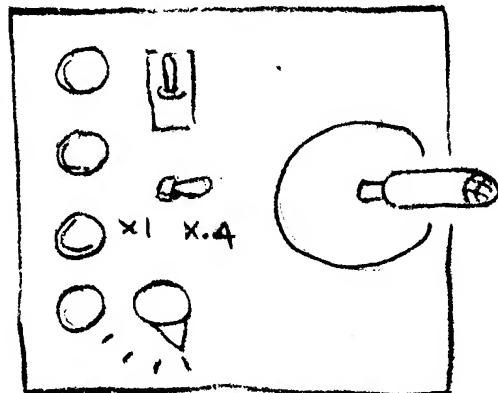
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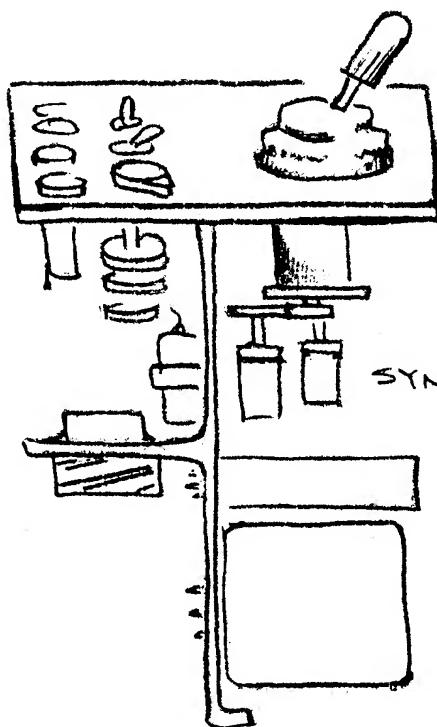
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-TOP PANEL -



SIDE VIEW